BAGLESS CANISTER VACUUM CLEANER

Cross-Reference to Related Application

This application claims priority from and hereby expressly incorporates by reference commonly owned U.S. provisional application No. 60/230,287 filed September 1, 2000.

Background of the Invention

Canister vacuum cleaners are well known and in widespread use. Typically, a canister vacuum cleaner comprises a main body housing including wheels that movably support the housing on a floor or other support surface. The housing carries a suction source such as a motor-driven fan assembly, and defines a bag-receiving region adapted to receive a disposable vacuum bag. An elongated hose extends outwardly from the housing and is in fluid communication with the disposable vacuum bag through a mouth of the bag.

In use of these conventional canister vacuum cleaners, the suction source establishes relative negative pressure inside the bag-receiving region so that an airstream is pulled into the hose and passes therethrough into the bag. Dust, dirt, and other contaminants entrained in the airstream are trapped inside the bag while the airstream passes through the bag and exits the bag-receiving region of the housing. The airstream is then exhausted from the housing by the suction source.

Recently, bagless upright vacuum cleaners have been developed that rely upon a dirt separation chamber to separate contaminants from an airstream without use of a bag. The separated contaminants are collected in a dirt cup or like container which must be emptied periodically. Because these types of vacuum cleaners do not require use of disposable bags, they have been found to be highly convenient and cost-effective to operate.

In light of the success of bagless upright vacuum cleaners, it has been deemed desirable to develop a bagless canister vacuum cleaner displaying corresponding effectiveness and convenience of use.

Summary of the Invention

In accordance with a first aspect of the present invention, a canister vacuum cleaner includes a body defining a suction inlet and an exhaust outlet, and a suction source contained in the body and located fluidically between the suction inlet and the exhaust outlet. A dirt cup is releasably connected to the body. The dirt cup defines a dirt separation chamber and an airstream outlet that releasably mates with the suction inlet when the dirt cup is connected to the body. The dirt separation chamber is conformed to impart a rotational flow pattern to an airstream passing therethrough whereby contaminants entrained in the airstream are separated from the airstream and deposited in the dirt cup. A filter is located in the dirt separation chamber of the dirt cup in covering relation with the airstream outlet.

In accordance with another aspect of the present invention, a bagless vacuum cleaner includes a body and a dirt cup releasably connected to and selectively separable from the body. A plurality of wheels are each connected to one of the body and the dirt cup and movably support the body and the dirt cup on an associated support surface when the dirt cup is connected to the body. At least one of the wheels is connected to the dirt cup.

In accordance with a further aspect of the present invention, a bagless canister vacuum cleaner includes a main housing defining a suction source inlet, an exhaust outlet and a receiver region adapted to receive a dirt cup. A suction source is located fluidically between the suction source inlet and the exhaust outlet. A dirt cup is releasably coupled to the receiver region of the main housing. The dirt cup includes: (i) an interior wall defining a dirt separation chamber; (ii) an open first end in communication with the dirt separation chamber; and, (iii) a closed second end with an aperture forming an airstream outlet from the dirt separation chamber. The dirt cup is releasably coupled to the main housing with the airstream outlet of the dirt cup mated with the suction source inlet of the main housing. A filter assembly is releasably connected to the dirt cup and is located in the dirt separation chamber. The filter assembly includes a filter element located in covering relation with the airstream outlet of

the dirt cup and is positioned so that an annular airflow space is defined between the filter element and the interior wall of the dirt cup. A cover is pivotably connected to the housing and is movable between an open position, where the cover is disengaged from the dirt cup, and a closed, operative position where said the is placed in covering relation with and blocks the open first end of the dirt cup. The cover, when located in the closed position, prevents separation of the dirt cup from the main housing.

In accordance with still another aspect of the invention, a bagless canister vacuum cleaner includes a main housing defining an airflow inlet, an airflow outlet and a receiver region adapted to receive a dirt cup. A suction source is located in the housing and is operational to establish and maintain an airstream that flows from the airflow inlet to the airflow outlet. A dirt cup is releasably coupled to the receiver region of the main housing. The dirt cup includes: (i) an interior wall defining a dirt separation chamber conformed to impart a rotational flow path to a dirty airstream passing therethrough whereby contaminants are separated from the dirty airstream and deposited in the dirt cup; (ii) an open first end in communication with the dirt separation chamber; and, (iii) an airstream outlet from the dirt separation chamber, the dirt cup releasably coupled to the main housing with the airstream outlet of the dirt cup mated with the airflow inlet of the main housing. A filter assembly is releasably connected to the dirt cup and is located in the dirt separation chamber. The filter assembly comprises a filter element located in covering relation with the airstream outlet of the dirt cup. A cover is connected to the housing and is movable between an open position, where it is disengaged from the dirt cup, and a closed, operative position where it is placed in covering relation with and blocks the open end of the dirt cup. The cover, when located in its closed position, prevents separation of the dirt cup from the main housing.

In accordance with a still further aspect of the present invention, a bagless vacuum cleaner includes a main housing defining a suction source inlet, an exhaust outlet and a receiver region adapted to receive a dirt cup. A suction source is located fluidically between the suction source inlet and the

exhaust outlet. A dirt cup is releasably coupled to the receiver region of the main housing. The dirt cup includes: (i) an interior wall defining a dirt separation chamber; (ii) an open first end in communication with the dirt separation chamber; and, (iii) an airstream outlet from the dirt separation chamber. The dirt cup is releasably coupled to the main housing with said airstream outlet of the dirt cup mated with the suction source inlet of the main housing. A filter assembly is releasably connected to the dirt cup and is located in the dirt separation chamber. The filter assembly includes a filter element located in covering relation with the airstream outlet of the dirt cup and positioned so that an annular airflow space is defined between the filter element and the interior wall of the dirt cup. A base is connected to the main housing and is conformed to support the main housing, and the dirt cup releasably connected to the receiver region of the main housing, on the support surface in a second, non-operative position, with the open first end of the dirt cup located at a select elevation relative to the dirt separation chamber to prevent spillage of associated dirt and debris contents of the dirt separation chamber from the open first end of the dirt cup.

In accordance with another aspect of the present invention, a vacuum cleaner includes a housing; a dirt cup releasably connected to the housing and defining a dirt separation chamber; a filter located in the dirt separation chamber of the dirt cup; and, a suction source located in the housing and in fluid communication with the dirt separation chamber. The suction source, when selectively operated, establishes and maintains a suction airstream that flows into and through the dirt separation chamber to an exhaust outlet defined by the housing. The suction airstream, when moving through the dirt separation chamber, moves rotationally around a substantially horizontal axis of the filter before passing through the filter and exiting the dirt separation chamber.

In accordance with still another aspect of the present invention, a bagless vacuum cleaner includes a body and a dirt cup releasably connected to and selectively separable from said body. The dirt cup includes a handle and a

pour spout.

Still other benefits and advantages of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following specification.

Brief Description of the Drawings

The invention comprises a variety of components and arrangements of components, a preferred embodiment of which is illustrated in the accompanying drawings that form a part hereof and wherein:

FIGURE 1 is a perspective view of a bagless canister vacuum cleaner formed in accordance with the present invention;

FIGURE 2 is a left side elevational view of the vacuum cleaner shown in FIGURE 1;

FIGURE 3 is a front elevational view of the vacuum cleaner shown in FIGURE 1;

FIGURE 4 is an exploded perspective view of a dirt cup and associated filter assembly of the vacuum cleaner shown in FIGURE 1;

FIGURE 5 is a sectional view along line 5-5 of FIGURE 3;

FIGURE 6 is a sectional view along line 6-6 of FIGURE 2;

FIGURE 7 is a sectional view along line 7-7 of FIGURE 5;

FIGURE 8 is a sectional view along line 8-8 of FIGURE 2; and,

FIGURE 9 is an exploded left side view of the vacuum cleaner shown in FIGURE 1, with the cover in an open position and with the dirt cup separated from the main housing for emptying.

Detailed Description of Preferred Embodiment

Referring now to the drawings, wherein the showings are for purposes of illustrating a preferred embodiment of the invention only and not for purposes of limiting same, FIGURE 1 illustrates a bagless canister vacuum cleaner **A** formed in accordance with the present invention. The vacuum cleaner

A generally comprises a main housing **B**, a cover **C**, a dirt cup **D**, a hose **E**, a filter assembly **F** (FIGURE 6) positioned in the dirt cup, and a suction source **G** (FIGURES 5,6,8). A tool, such as a crevice tool **H** illustrated herein, is carried by the distal end of the hose. The main housing **B** includes or defines a handle **26** to facilitate carrying of the vacuum cleaner **A**. First and second strap supports **28a,28b** are connected to the main housing **B** and project outwardly therefrom. A carrying strap **S** (shown only partially) is connected at opposite ends to the supports **28a,28b**, respectively, and can be placed over the shoulder of a user for hands-free carrying of the vacuum cleaner **A**.

The main housing **B** is defined from a plurality of interconnected molded plastic pieces. One or more wheels **10** are rotatably connected to the main housing and movably support same on a floor or other support surface.

As illustrated in FIGURES 5, 6 and 8, the main housing supports the suction source **G** therein. The suction source can comprise an electrically driven motor operably coupled to a fan/impeller assembly that rotates in response to operation of the motor. The suction source **G** establishes and maintains an airstream that flows from an suction source inlet **20** to an exhaust outlet **22**, both defined by the housing **B**.

The dirt cup **D** is releasably connected to the main housing **B**. With reference to FIGURES 4-6 and 9, the dirt cup **D** is defined as a one-piece construction or from a plurality of interconnected pieces of molded plastic, and a hollow interior dirt separation chamber **30** is defined therein by an inner wall **31**. At least the portion of the dirt cup **D** in which the dirt separation chamber **30** is defined can be molded from transparent or partially transparent plastic so that a user of the vacuum cleaner **A** can view the dirt and other contents or at least appreciate the volume of the contents.

The dirt cup **D** defines an open first end **32** and an end wall **34** closes the opposite, second end thereof. However, a dirt cup airstream outlet **36** is defined through the end wall **34** and is located and dimensioned to mate closely with the suction source inlet **20** when the dirt cup **D** is operably

connected to the main housing **B** as illustrated, e.g., in FIGURES 4 and 5. An O-ring gasket or the like **38** can be located at the interface of the dirt cup airstream outlet and the suction source inlet **20** and sealingly engages these openings. If desired, a screen or filter **40** can be positioned in the suction source inlet **20** as an emergency filter to prevent passage of potentially damaging contaminants into the suction source **G** should any pass through the dirt cup airstream outlet **36** due to a malfunction or misuse of the vacuum cleaner.

The dirt cup **D** further comprises an external handle assembly **50** projecting outwardly therefrom. The handle assembly comprises a handle member **52** adapted for being held by a user of the vacuum cleaner **A**, and a wheel assembly **54**. When the dirt cup **D** is operably connected to the main housing **B** as shown in FIGURES 1-3, and with the vacuum cleaner **A** in its operative position, the wheel assembly **54** works together with the wheels **10** to movably support the vacuum cleaner **A** on a floor or other support surface. The wheel assembly **54** includes a caster wheel or the like **56** that facilitates steering of the vacuum cleaner **A** on the floor or other support surface. In an alternative embodiment, multiple wheels can be connected to the dirt cup without departing from the overall scope and intent of the present invention.

The dirt cup **D**, adjacent the open first end **32** and opposite the handle assembly **50**, includes or defines a spout **58**. The spout facilitates emptying of dirt and other contents of the dirt cup in a pouring operation when a user is holding the dirt cup by the handle assembly **50**.

With reference to FIGURES 5 and 9, the main housing **B** defines a socket, recess or other receiver region **60** adapted to receive the dirt cup therein so that the dirt cup is operably positioned. The dirt cup **D**, itself, includes or defines a tongue or like projection **62** adjacent the second end thereof that releasably mates with a corresponding female receptacle **64** secured to or defined by the housing **B**. The members **62,64** are engageable with a sliding action and disengageable with a reverse sliding action while the dirt cup D is simultaneously tilted or pulled away from the inner wall **66** of the housing recess

60 by application of manual force on the handle **52**.

The cover assembly **C** of the vacuum cleaner **A** is pivotally or otherwise movably connected to the main housing **B**. As shown herein, the cover assembly **C** is pivotally connected to the main housing **B** by a hinge assembly **70** so that it pivots on an arc **72** (FIGURE 9) between an open or inoperative position (as shown in FIGURE 9) and a closed or operative position (as shown in FIGURES 1-3, 5, 6). With reference briefly to FIGURE 4, the cover assembly **C** comprises a cover member **74** adapted to sealingly engage and close the open first end **32** of the dirt cup **D** when the cover assembly **C** is operably positioned. A gasket **76** is connected to the inner face of the cover member **74** and sealingly engages the cover member **74** to the open first end **32** of the dirt cup **D**.

Referring also to FIGURES 5 and 9, a handle assembly **80** is connected to and projects outwardly from the cover member **74**. The handle assembly **80** includes a handle **82** adapted for being held by a user of the vacuum cleaner **A** for purposes of pivoting the cover member **74** on the arc **72**. A latch **84** is connected to the cover member **74** and is biased into a normally engaged position by a spring **86**. A portion of the latch **84** projects through the handle **82** and is manually operable by a user to disengage a projecting tongue **88** of the latch **84** from a mating female portion **90** connected to or defined in the dirt cup **D** or, alternatively, the housing **B**. With the latch disengaged, the cover member **74** is freely movable away from the open first end of the dirt cup **D**. In contrast, with the cover member **74** seated on the open first end of the dirt cup and with the latch **84** of the cover assembly engaged with the portion **90** of the dirt cup, the dirt cup is fixedly and operably secured in the housing recess **60** with the dirt cup airstream outlet **36** fluidically communicating with the suction source inlet **20** as described.

A hose fitting **100** is connected to or forms a part of the cover assembly **C**. The hose fitting **100** comprises an inlet conduit **102** that projects outwardly away from the cover assembly **C** and that is adapted for connection

to a conventional vacuum cleaner hose **E** (Fig. 1) so that the hose communicates with a passage **104** formed through the inlet conduit **102**. The hose fitting **100** further comprises an outlet conduit **108** that, together with the cover member **74** defines a passage **110** that communicates with the passage **104** in the inlet conduit **102**. With the cover assembly **C** in its operative position, the outlet conduit **108** is located in or adjacent the open first end **32** of the dirt container **D** so that the passages **104,110** are both in fluid communication with the dirt separation chamber **30** defined in the dirt cup **D**. As illustrated herein, the outlet conduit **108** can be obliquely arranged relative to the interior wall **31** of the dirt container **D** so that an airstream delivered to the dirt separation chamber **30** from the outlet **108** is directed toward the dirt cup inner wall **31** adjacent the open first end of the dirt cup **D**. This imparts a rotational pattern to the airstream that enters the dirt separation chamber **30** by way of the hose fitting outlet **108**.

The filter assembly **F** is releasably secured in the dirt cup **D**, and can be located coaxial with the longitudinal axis **L** thereof as shown in FIGURE 5. The filter assembly comprises a frame **120** defined from one or more pieces of molded plastic, and a filter element **122** comprising paper, plastic, or any other suitable filter medium that is carried by the frame **120**. The filter element **122** can comprise a pleated washable filter medium such as GORE-TEX® brand polytetrafluoroethylene (PTFE) or another polymeric filter medium. With reference to FIGURES 4 and 5, the filter frame **120** comprises: (i) a base plate **120a** adapted to fit adjacent a lower edge **122a** of the filter element **122**; (ii) an internal skeleton **120b** connected at a second end to the base plate **120a** and adapted to fit closely within a central opening **126** defined in the filter element **122**; and, (iii) a cap **120c** connected to a first end of the skeleton **120b** and that closes the opening **126** at the upper edge **122b** of the element **122**.

With continuing reference to FIGURES 4 and 5, the base plate **120a** defines an opening **124** adapted to frictionally or otherwise releasably mate with a boss **130** projecting from the end wall **34** of the dirt cup **D** around the dirt

cup airstream outlet **36**. A gasket **128** can be connected to the filter assembly base plate **120a** to engage and seal together the base plate **120a** and the dirt cup end wall **34**. With the base plate **120a** and boss **130** mated as described or in an equivalent manner, the filter assembly **F** is releasably connected to the dirt cup in an operative position and is self-supporting within the dirt cup, with a longitudinal axis of the filter assembly **F** located close to parallel with the support surface (typically at least substantially horizontal) on which the wheels 10,56 are located, i.e., inclined less than about 20° - 25° relative to the associated support surface.

With the filter assembly **F** in its operative position, it is located in covering relation with the dirt cup airstream outlet **36** so that an airstream exiting the dirt separation chamber **30** through the dirt cup airstream outlet **36** must pass through the filter element **122**. As shown in FIGURES 4 and 7, the cap **120c** of the filter assembly **F** is defined with an integral scalloped grip or the like to facilitate manual grasping of the filter element **F** as required to connect same to and disconnect same from the dirt cup **D**.

Downstream from the suction source **G**, a final filter or exhaust filter **140** (FIGURE 8) can be located between the suction source **G** and the exhaust outlet **22** of the main body **B**. The exhaust filter **140**, which can comprise a HEPA or conventional filter medium, filters contaminants from the airstream exhausted by the suction source **G** before same exits the main housing **B** through the exhaust outlet **22**.

Referring now to FIGURES 5-7, in operation, the suction source **G** establishes and maintains an airstream **S** that flows from the hose **E** (FIGURE 1) into the dirt separation chamber **30** by way of the hose fitting outlet **108**. Owing to the generally annular airflow space defined between the filter assembly **F** and the dirt cup inner wall **31**, and due to the oblique arrangement of the outlet **108** by which the airstream **S** passes into the chamber **30**, the airstream flows in a rotational manner around the filter assembly F and simultaneously moves from the open first end **32** toward the opposite end wall **34** of the dirt cup **D**. The

rotational airflow dislodges contaminants that are entrained in the airstream **S**. The dislodged contaminants are collected in the dirt separation chamber **30**. The flow of the airstream as described tends to urge the collected contaminants toward the wall **34** at the second end of the dirt cup **D**.

The airstream **S** then passes through the filter element **122** that removes residual contaminants therefrom (a portion of the airstream S also passes through the collected dirt and other contaminants in the dirt cup which act as an auxiliary filter media). After passing through the filter element **122**, the airstream **S** exits the dirt cup **D** through the dirt cup airstream outlet **36** and flows through the suction source **G** and is exhausted thereby. The airstream exhausted by the suction source passes through the exhaust filter **140** (FIGURE 8) that removes more residual contaminants therefrom, and the airstream then exits the main housing **B** through one or more exhaust outlets **22**.

The main housing **B**, at a second end opposite the cover assembly **C**, defines or includes a base **150** conformed to support the vacuum cleaner **A** in a second, non-operative position on a floor or other support surface with at least the wheel **56** and/or all wheels **10,56** not in contact with the floor or other support surface. The base **150** can be conformed as a face that is adapted to support the vacuum cleaner **A** with the dirt cup **D** in an upright position, with the open upper end **32** at a higher elevation than the opposite end wall **34** located at the second end thereof, e.g., with the dirt cup vertically oriented as shown in FIGURE 9. With the vacuum cleaner **A** in this second, non-operative position, the handle assembly **80** of the cover assembly **C** and the handle assembly **50** of the dirt cup **D** are freely accessible by a user so that the dirt cup can be separated from, emptied, and reconnected to the main housing as described above.

From the foregoing, it should be apparent that the present invention relates to a new and improved bagless canister vacuum cleaner. The bagless canister vacuum cleaner includes a selectively removable dirt cup, wherein an airstream flows rotationally through the dirt cup between an interior

wall of the dirt cup and a filter assembly selectively mounted in the dirt cup so that entrained contaminants are separated from the airstream flowing through the dirt cup and collected by the dirt cup. A cover member is pivotally or otherwise movably connected to a main housing, and the cover member is selectively movable to and held in an operative position in covering relation with an open first end of a dirt cup. Also, the main housing defines a base conformed to self-support the main housing on a support surface with the dirt cup arranged with its open first end at a higher elevation than its closed second end. The removable dirt cup includes a handle adapted for being held by a user, and the dirt cup defines or includes a spout to facilitate emptying dirt therefrom.

The invention has been described with reference to a preferred embodiment. Modifications and alterations will occur to others upon reading and understanding this preceding specification. It is intended that the invention be construed as including all such modifications and alterations insofar as they are encompassed by the appended claims as construed literally and/or according to the doctrine of equivalents.